## Space Weather Forecast

Issued on Sunday, 24 December 2023 at 12:34 Local

**This forecast provides a four-day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales**

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**Space Weather Forecast Headline: Chance of Moderate-class X-ray flares throughout. Chance of Minor Solar Radiation Storm S1 in near-term.**

### Analysis of Space Weather Activity over past 24 hours

**Solar Activity:** Solar activity rose to Moderate levels in the past 24 hours. While the X-ray trace was largely flat with occasional small Common-class flares observed, this abruptly ended with a late peak Moderate-class event observed at 24/1118UTC from a hitherto subdued sunspot region in the southwest centre of the Sun. It is not yet clear from the time of writing as to whether any Coronal Mass Ejection (CME) was produced, with imagery awaited.

There remain eight sunspot regions on the Earth-facing side. The main changes in the period were seen in the northeast, with recent growth in two sunspots here. All other groups were apparently stable or in decay.

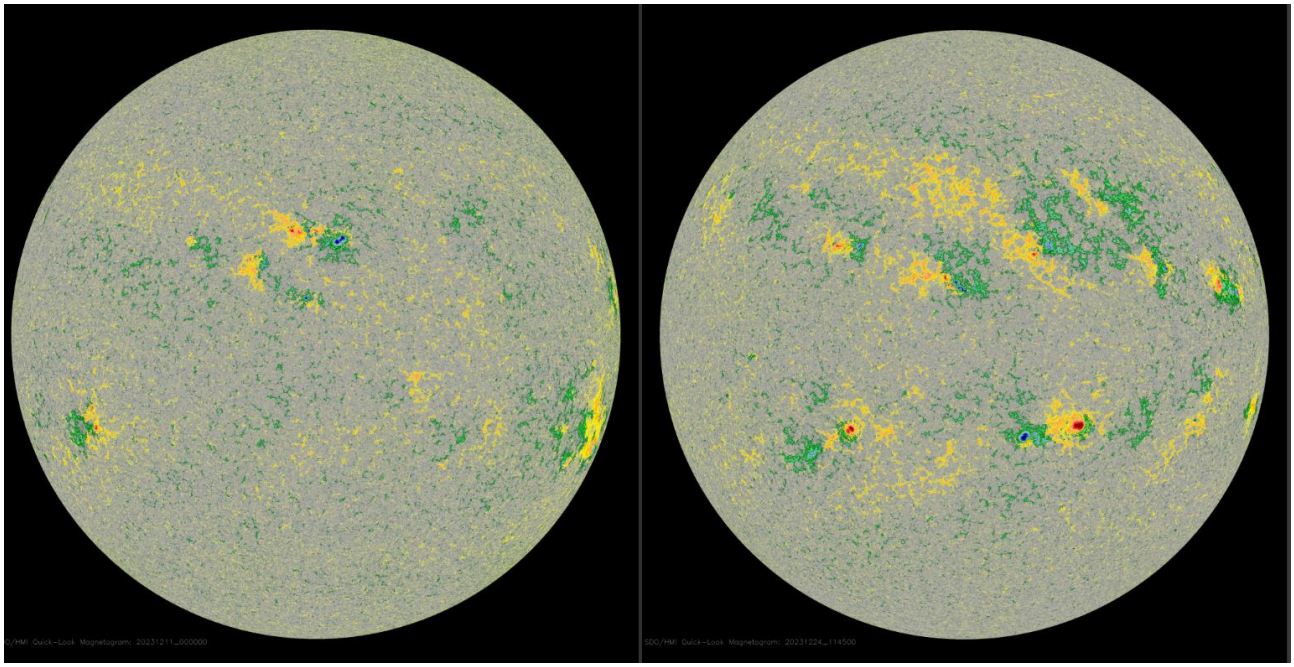

**Figure 0: Rough view of the far hemisphere (pictured on 10 December when facing Earth), and the current facing side (24 December, 1145UTC), showing a strong difference in the strength of polarisation (areas of yellow and green are opposing polarities). So far this has not had a large impact on flare activity, and the 'filaments' that occupy the current boundaries between the yellow and green areas appear mainly stable –perhaps due to the lack of larger flares from active regions.**

Magnetic solar imagery remains relatively starkly polarised at present, which is proving a fertile breeding ground for 'filaments' (arcs of plasma) on the boundaries of these areas. Two of these were relatively mobile over the 24 hours - mainly the large filament near 35 West solar longitude. A

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very faint and narrow CME, was perhaps associated with a period of disturbance in this feature peaking at 24/0130UTC, with part of the southern end perhaps the cause of the CME seen heading apparently south-poleward below the Sun-Earth line. Analysis of this will be conducted in due course, however it is felt most likely to be near a similar trajectory to the CME 24 hours earlier from a similar location - passing sufficiently below the ecliptic to not affect Earth. A second, slower lift-off then occurred in the northwest around 24/1100UTC. Imagery for this event is not yet available but is now the main source of monitoring. At the time of writing, no definitively Earth-directed CMEs were in evidence.

**Solar Wind / Geomagnetic Activity:** Solar winds initially showed a disturbed slow solar wind regime, perhaps polluted by a minor CME, but gave way to a probable minor fast wind after 23/1600UTC. The source of this fast wind is uncertain.

The solar wind speed was initially steady at background levels, but gradually rose after 23/1600UTC to eventually become slightly elevated into the current UTC morning. The number of particles in the wind was unremarkable, however the magnetic field entered the current 24-hour period strongly anti-aligned with Earth's field - perhaps CME-related. The magnetic field was more erratic thereafter, with a very slight rising tendency.

The net result of the above solar wind measures was for provisionally mainly quiet geomagnetic activity.

**Energetic Particles / Solar Radiation:** No solar radiation storms were observed.

## Four-Day Space Weather Forecast Summary

**Solar Activity:** There is a roughly stable daily chance of Moderate activity in the four-day period.

**Solar Wind / Geomagnetic Activity:** No Earth-directed CMEs feature in the forecast. Current slightly elevated solar winds should soon ease, with no further fast winds anticipated. Resulting geomagnetic activity should soon revert to quiet.

**Energetic Particles / Solar Radiation:** There is now an increased slight chance in the next 24 hours of passing Minor Solar Radiation Storm S1, given the Moderate-class X-ray flare from near 20 West. This risk should fade to background later in the four days.

**Geomagnetic Storms:**

| Geo-Magnetic Storm Probability (Exceedance) | Level | Past 24 Hours (Yes/No) | Day 1 (00-24 UTC) (%) | Day 2 (00-24 UTC) (%) | Day 3 (00-24 UTC) (%) | Day 4 (00-24 UTC) (%) |
|---|---|---|---|---|---|---|
| Minor or Moderate | G1 to G2 | No | 1 | 1 | 1 | 1 |
| Strong | G3 | No | 1 | 1 | 1 | 1 |
| Severe | G4 | No | 1 | 1 | 1 | 1 |
| Extreme | G5 | No | 1 | 1 | 1 | 1 |

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**Radio Blackouts - X Ray Flares:**

| X Ray Flares<br>Probability | Level | Past 24 Hours (Yes/No) | Day 1 (00-24 UTC)<br>(%) | Day 2 (00-24 UTC)<br>(%) | Day 3 (00-24 UTC)<br>(%) | Day 4 (00-24 UTC)<br>(%) |
|---|---|---|---|---|---|---|
| Active | R1-R2 M Class | Yes | 40 | 40 | 40 | 40 |
| Very Active | R3 to R5 X | No | 5 | 5 | 5 | 5 |

**Solar Radiation Storms - (High Energy Protons):**

| Radiation Storms<br>Probability (Exceedance) | Level ($cm^{-2}$ $sr^{-1}$ $s^{-1}$) | Past 24 Hours (Yes/No) | Day 1 (00-24 UTC)<br>(%) | Day 2 (00-24 UTC)<br>(%) | Day 3 (00-24 UTC)<br>(%) | Day 4 (00-24 UTC)<br>(%) |
|---|---|---|---|---|---|---|
| Active | ≥ S1 | No | 20 | 15 | 10 | 10 |
| Very Active | ≥ S3 * | No | 1 | 1 | 1 | 1 |
| * S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$) | | | | | | |

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